DOCUMENT RESUME

ED 136 963 PS 009 221

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TITLE Mother-Infant Interaction and Cognitive Development in the 12-Week-Old Infant.
PUB DATE Mar 77
NOTE 16p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (New Orleans, Louisiana, March 17-20, 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Birth Order; *Cognitive Development; Infant Behavior; *Infants; *Interaction Process Analysis; *Mothers; *Parent Child Relationship; *Perceptual Development; Research
IDENTIFIERS Bayley Mental Developmental Index; Object Permanence

ABSTRACT

This study explored the relationship between the mother-infant interaction and the concurrent perceptual-cognitive and intellectual status of the infant. One hundred and eight-nine 12-week-old infants were given a battery of perceptual-cognitive tasks, including the Mental Developmental Index (MDI) of the Bayley Scales, the Corman-Escalona Scales of Object Permanence, and an attention task measuring response decrement and recovery. Data from these tests failed to show any sex or social class differences. However, the MDI was affected by birth order with first borns showing superior performance. In general, these three measures of perceptual-cognitive ability were unrelated. Mother-infant interactional data were collected and analyzed on three levels; frequency distributions, determination of simultaneous behaviors, and directed interactional behavior. The third level of anlaysis yielded more conclusive results concerning relationships between maternal behavior and infant performance. These findings suggest that specific contingencies between maternal and child behaviors are more informative than simple frequencies of behavioral occurrences, and that mother-infant interactional behavior is related to the young infant's cognitive status. (Author/SB)

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Mother-Infant Interaction and Cognitive Development in the 12-Week-Old Infant[1]

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Educational Testing Service

Most developmental psychologists would agree that the experience of the human infant with its social world, especially that of its mother, contributes significantly to the child's current and subsequent social and personality development. However, some controversy continues surrounding the notion that the social environment affects the infant's cognitive-intellectual development. This paper is not directed at the nature-nuture issue, as the model of development in the following investigation is seen as highly interactional. Nevertheless, the present study is designed to explore the relationship between the mother-infant interaction and the concurrent perceptual-cognitive and intellectual status of the infant.

Recently, Lewis and Lee-Painter (1974) characterized mother-infant interactions in terms of multiple levels of analysis. Frequency distributions constitute the simplest level of analysis. In this instance, only the amount or frequency of infant or maternal behavior is noted. These types of data (for example, how much vocalization, smiling, or touching has occurred) are most often reported in mother-infant studies, possibly due to the fact that they are the easiest to obtain and score with any degree of reliability. While they are considered interactional in nature since they are tallied when the mother and infant are together, they are quite often assumed to be causal. Unfortunately, the modes of causality and interactive quality of frequency data are extremely limited.

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[1]Paper presented at the Society for Research in Child Development Meeting, New Orleans, March 1977.

A higher level of analysis is termed complex interaction. By using this analysis it is possible to record the occurrence of interactive behaviors. This analysis generates such information as the amount of behavior that occurs in interaction, the amount of behavior that is responsive or initiative.

The qualitatively most descriptive level of analysis is called a directed-interactional analysis. In this instance, specific, directed behaviors between mother and infant are studied. This method of analysis allows us to determine specific behavioral interactions; that is, who does what to whom. This analysis captures both the initiating and responding quality of interaction as well as what behaviors make up this interaction. Unfortunately, only two-chain interactions are analyzed, all longer chains being broken down into two-unit chains.

In the present study, one hundred and eighty-nine twelve-week-old infants were given a battery of perceptual-cognitive tasks. These included the Mental Developmental Index of the Bayley Scales of Infant Development, the Corman-Escalona Scales of Object Permanence, and an attention task measuring habituation and dishabituation. Using a modified version of the Hollingshead Two-Factor Index of Social Position (1957), this sample (94 females and 95 males) was divided into 90 high SES subjects and 99 low SES subjects, Subsequently, the sample was grouped into four birth orders as follows: 61 first borns, 58 second borns, 49 third borns, and 21 fourth borns.

Procedure

The Bayley was administered in the infant's home following a two-hour observation of mother-infant interactions. The Corman-Escalona Scales were

given in the Infant Laboratory of Educational Testing Service at the same time as the administration of an attentional task. In both instances, the mother was always present. Testers consisted of a pool of Caucasian females who had been trained on all aspects of each scale and had met an agreement score of .85.

The attention task measured responsivity to visual stimuli. Specifically, fixation time was obtained as the infants watched seven trials of a visual array, each 30 seconds in duration with a 30-second intertrial interval. The first six trials were redundant--a slide of 20 straight colored lines--while the seventh trial consisted of 20 curved colored lines. The stimuli were presented by rear screen projection while the infant and its mother sat in an enclosure. (The infant sat in an infant seat while its mother sat to the side and rear of her child.) Fixation time was determined by a trained observer who depressed a push button each time the stimulus was superimposed on the infant's pupil. Interobserver reliability taken on 15% of the subjects was consistently high. For each subject, the amount of time spent looking during each trial for each observer was obtained and individual subject reliability determined. The range was .87 to .99 with a mean reliability score of .93.

First and total fixation time (in seconds) were obtained as measures of habituation and recovery. First fixation was the amount of time the infant first looked before turning away during a stimulus presentation. Total fixation was the total amount of looking time accrued over all 30 seconds of presentation. In this study, habituation was defined as the score based on the difference in attending behavior between trial #1 and trial #6, while recovery was defined as the score based on the difference in attending behavior

between trial #6 and trial #7. Individual subject scores for habituation $(\frac{1-6}{1})$ and recovery $(\frac{6-7}{6})$ were used in these analyses.

During the 2-hour mother-infant observation period, mothers were instructed that the observer was interested in studying the infant's behavior. The observer sat next to but out of sight of the infant. It was stressed that it was the infant who was to be observed--not the mother. Moreover, the mother was to try to forget the presence of the observer and not engage her in conversation. Prior to the observation period, the observer spent time with the mother attempting to put her at ease.

The observational data were collected using a computer scan checklist sheet. Each sheet represents 60 seconds divided into six 10-second columns. Infant behaviors observed were: eyes closed (if closed for more than three 10-second periods observation stopped until baby was awake), vocalization, extra movement (all gross physical movements), fret/cry, smile, quiet play (watching a toy move, playing with fingers). Maternal behaviors included: discrete touch, hold, vocalization, look, smile, play, change, feed, rock, give toy/pacifier, vocalization to others, reading/TV.

Results

Since mother-infant interactions and infant perceptual-cognitive performance were influenced by such variables as sex, social class, and birth order, all of the correlations to be presented were partialed for these effects. Briefly, there were no gender or social class differences on the MDI. With respect to birth order, the MDI scores varied inversely with ordinal position. Thus, first borns achieved the highest scores ($F(3,135) = 2.76$, $p < .04$). There were no group differences with respect to birth order, social class, or gender in infant object permanence performance or in the attentional task.

Insert Figure 1 about here

Figure 1 presents the correlations between infant Bayley scores and maternal behavior as measured in a variety of ways. MBF (maternal behavior frequencies) represents the total number of maternal behaviors directed toward her infant during the two hours of observation time. MBF (P - proximal) represents the total number of proximal behaviors. These proximal behaviors included: touching, holding, playing with subject, change/bathe, feeding subject, rocking subject, kissing infant, give infant toy. MBF (D - distal) represents the total number of distal behaviors. These distal behaviors included: vocalizing, vocalizing to others present, looking, smiling, reading or watching television. These correlations indicated a negative relationship between the maternal frequency behaviors and infant MDI scores. Similar findings were reported in another study (see Lee-Painter & Lewis, 1974; Lewis & Coates, 1976) for another sample of 100 infants.

The interactive data present a different picture. B indicates the number of maternal responses, B/T the ratio of responsivity to the total behavior directed toward the infant, and A + B/T or the total amount of interactive behavior as a ratio of the total behavior of the mother, all show positive correlations, two of which are significant. Thus the level of maternal interaction and responsivity, rather than just frequency of maternal behavior, is positively related to the infant MDI scores.

Insert Figures 2a, 2b, 2c about here

The next three figures present specific directed interactions of the dyad -- selected maternal responses to infant vocalization, crying and smiling. Figure 2a presents infant vocalization and maternal responses of touching, vocalizing, smiling, feeding and total maternal response. Notice that all of the correlations are positive and maternal responses of touching and feeding are significantly correlated with MDI scores. Figure 2b presents maternal responses to infant crying. Interestingly, no directed interactions are positively correlated with the infant's MDI scores although maternal kissing to infant crying is significantly negatively related--a finding hard to explain. Figure 2c presents maternal responses to infant smiling. Again the interactions are postively related to infant MDI scores with maternal touching being significantly so.

These data indicate that not all maternal responses to specific infant behaviors are related to the child's MDI scores. At this point, however, the explanation for why some specific maternal behaviors are related to the infant's MDI performance and other specific maternal behaviors are unrelated to this performance is not clear. However, we should not expect all types of interactions to be related to infant cognitive performance.

Insert Figure 3 about here

Figure 3 presents the correlations between the infant object permanence performance and maternal behavior. Again, frequency measures of maternal behavior MBF and MBF-distal were negatively correlated to the infant's cognitive ability--this time as measured by the object permanence task. Although nonsignificant, all three interactive measures were positively correlated to the infant's performance.

With respect to the attention task, all subjects showed response decrement and recovery, however, group differences could not be demonstrated. Further, the correlational data between infant measures of habituation and maternal behavior were almost entirely negative, including the interactive measures.

Discussion

In a previous paper, Gallas and Lewis (1976) showed that there was no relationship between the three measures of perceptual-cognitive performance. The general failure to find any relationship between the three perceptual-cognitive tasks (MDI, object permanence and attention) strongly suggests that infant intelligence is not a unitary construct and that multiple measures of ability are needed. When assessing the relationship between mother-infant interaction and the infant's cognitive ability, the multiple dimensionality of the infant's capacity has to be taken into account.

In the present study and one reported by Lewis & Coates (1976) using a different sample, it was found that measures of maternal frequencies were either unrelated to concurrent infant performance or were negatively related. On the other hand, measures of mother-infant interaction and maternal responsivity both indicated positive relationships to cognitive performance. The failure of maternal frequency measures to be related to infant cognitive ability may be explained in several ways. (1) Maternal frequency is most easily manipulated by the mother and may be affected by her being observed. If so, the measurement obtained may not be a true estimate of what she does when she is alone with her child. Maternal interaction and responsivity is less easily open to this effect. (2) Maternal frequency may be determined

by the state of the infant. Thus, more upset infants may elicit more maternal behavior. Upset or irritable infants are less likely to show superior performance on the cognitive tasks. Some support for this notion comes from the uniformly negative correlations between infant-cry and maternal response and infant cognitive performance.

These findings raise several issues that need further systematic scrutiny. First, implied in the discussion has been the issue of causality, the mother's responsivity leading to the infant's cognitive performance. Of course, the correlational analysis does not provide us with information pertaining to this issue. It may be the case that infants who are more cognitively advanced are those same infants who are capable of entering into more elaborate interactive patterns. Second, the mother-infant interaction is extremely complex and we must continue to develop methodologies suitable for exploring this complexity. While multiple levels of analysis have been presented here, perhaps additional levels or a combination of levels would provide more adequate and specific information about the quality of the interaction and its relationship to the infant's cognitive capacity. Third, not all maternal interactions are related to the same outcomes. While maternal vocalization to infant vocalization was not related to concurrent MDI scores, Lewis and Cherry (in press) have recently found that this interaction is predictive of infant-maternal linguistic behavior when the infant is two years old. We should therefore not expect to find that all early interactions are related to all concurrent or subsequent outcomes.

The data reported in this paper coupled with the findings of Lewis and Coates (1976) clearly demonstrate a relationship between mother-infant interactions and infant cognitive performance existing from the first few months, thus supporting

the necessity of theories which consider these issues in dealing with intellectual capacity and development.

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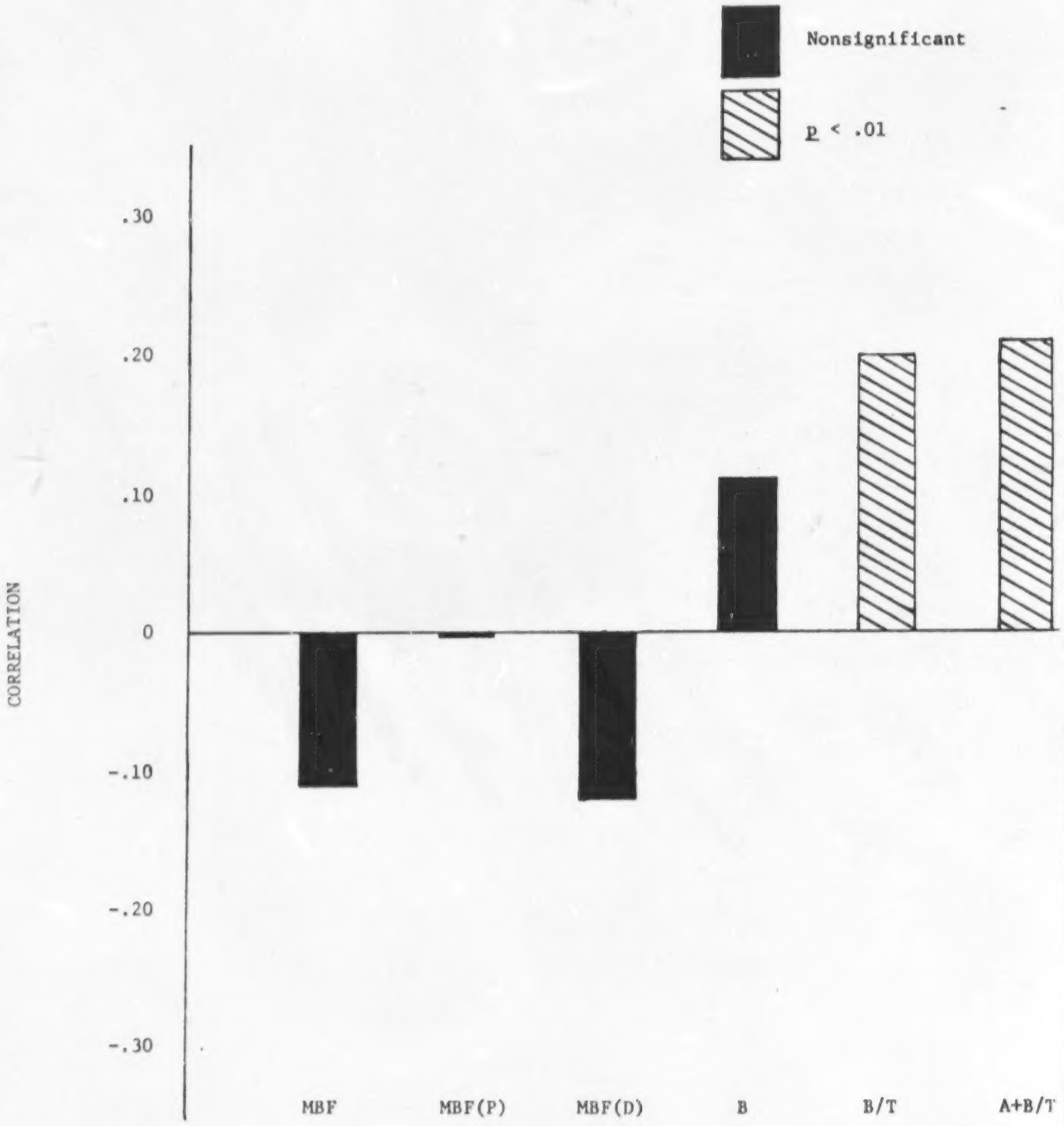

Figure 1: Correlation between Bayley MDI scores and maternal behavior.

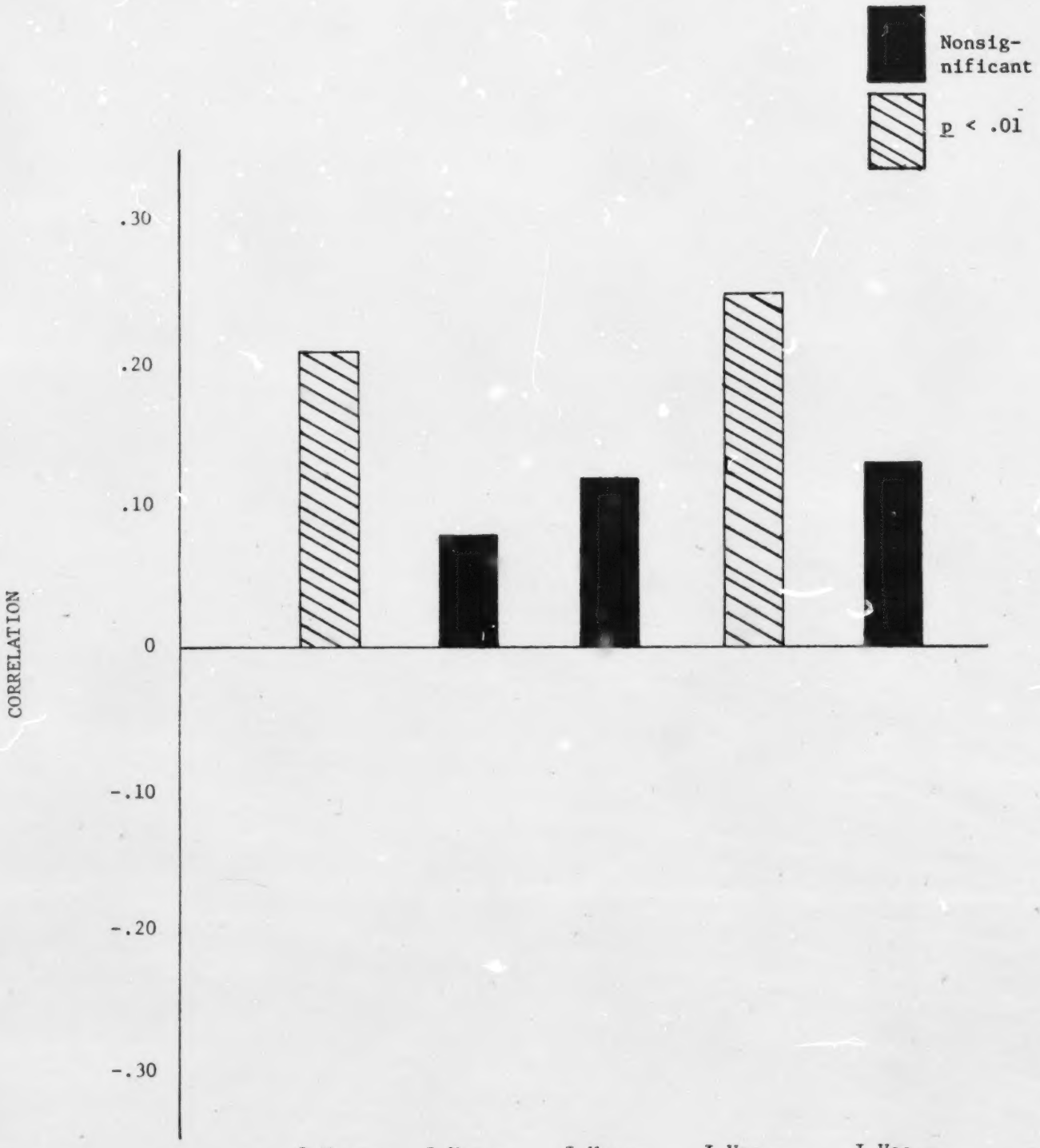

Figure 2a: Correlation between Bayley MDI scores and maternal directed interactions.

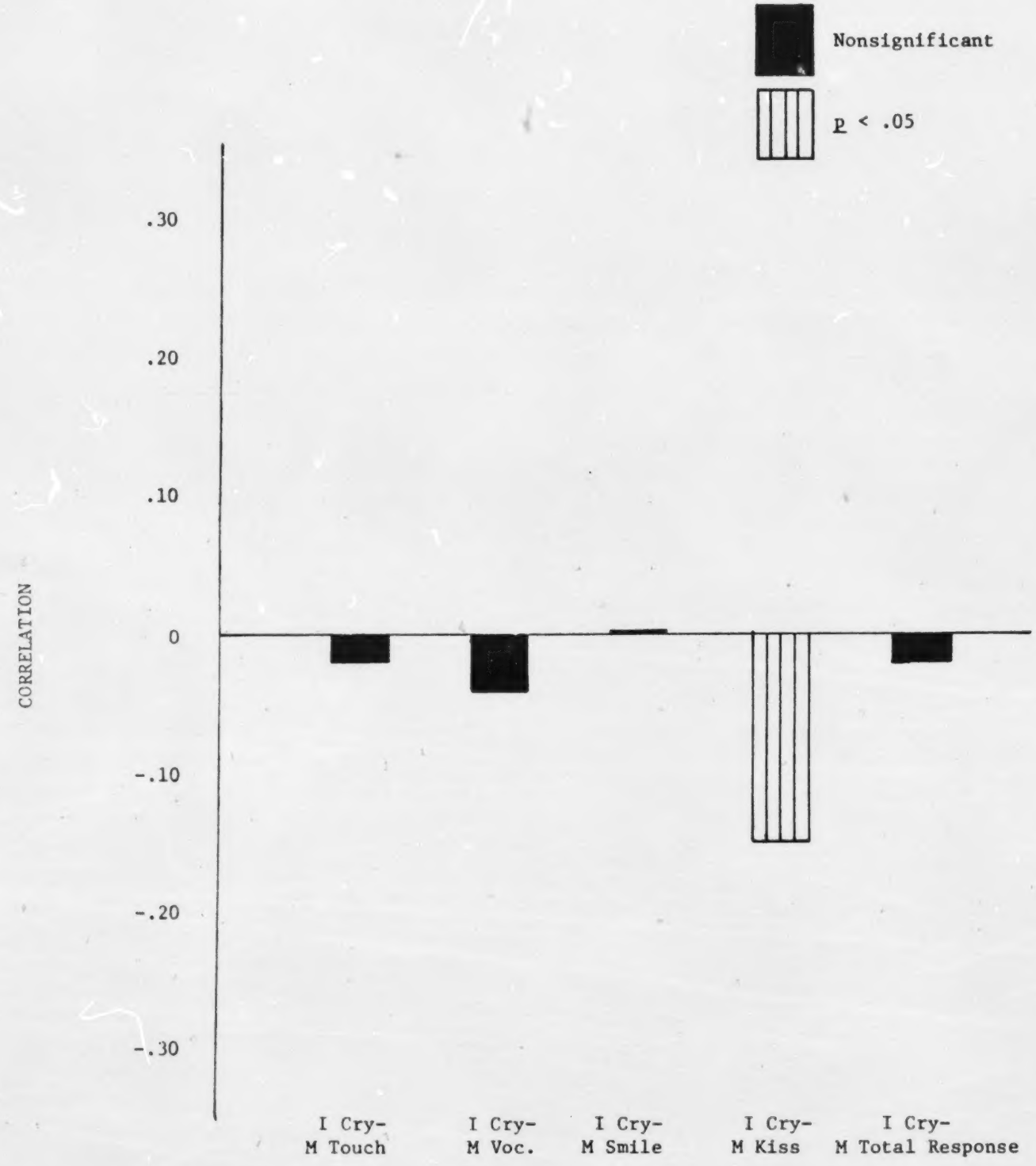

Figure 2b: Correlation between Bayley MDI scores and maternal directed interactions.

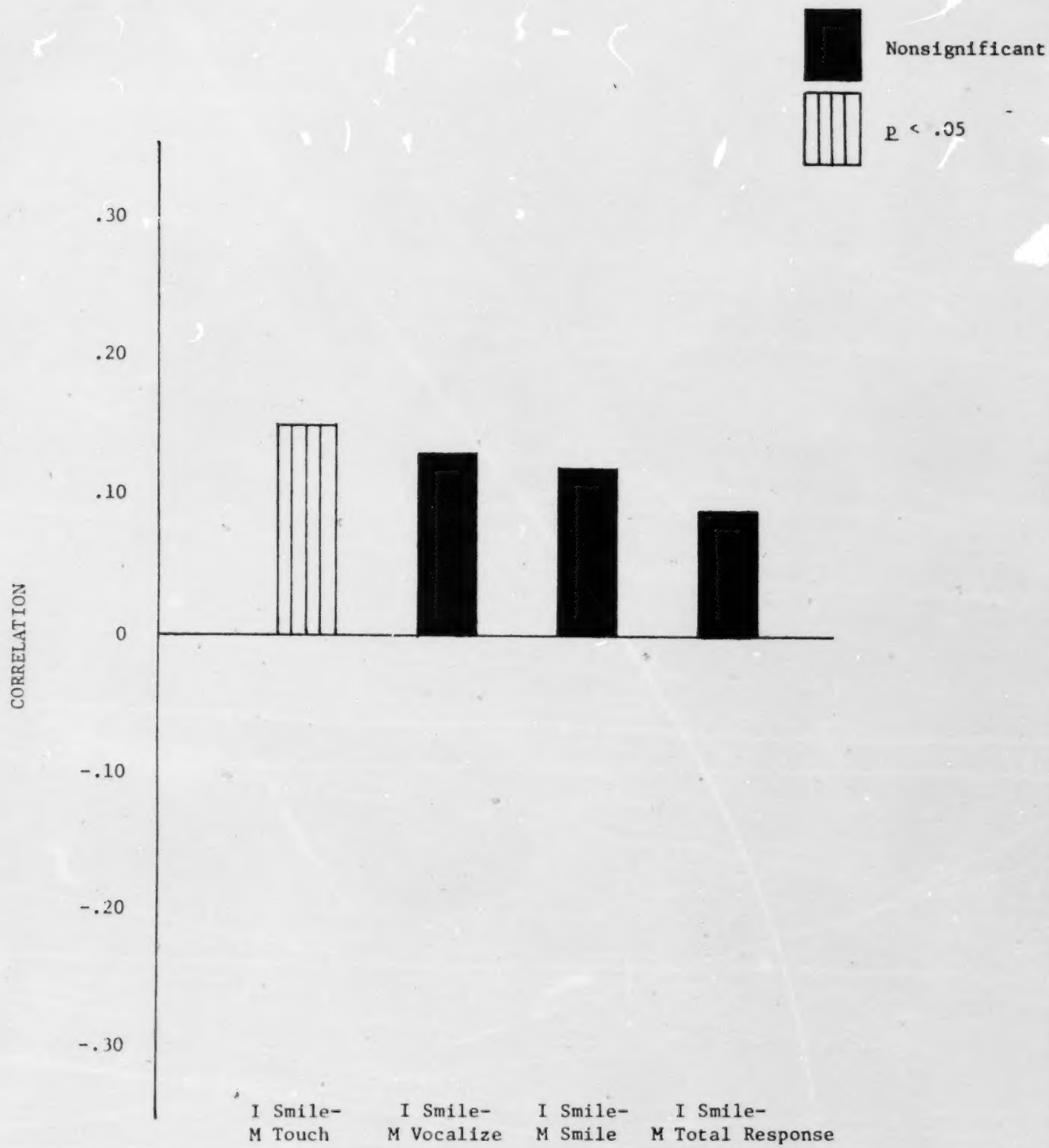

Figure 2c: Correlation between Bayley MDI scores and maternal directed interactions.

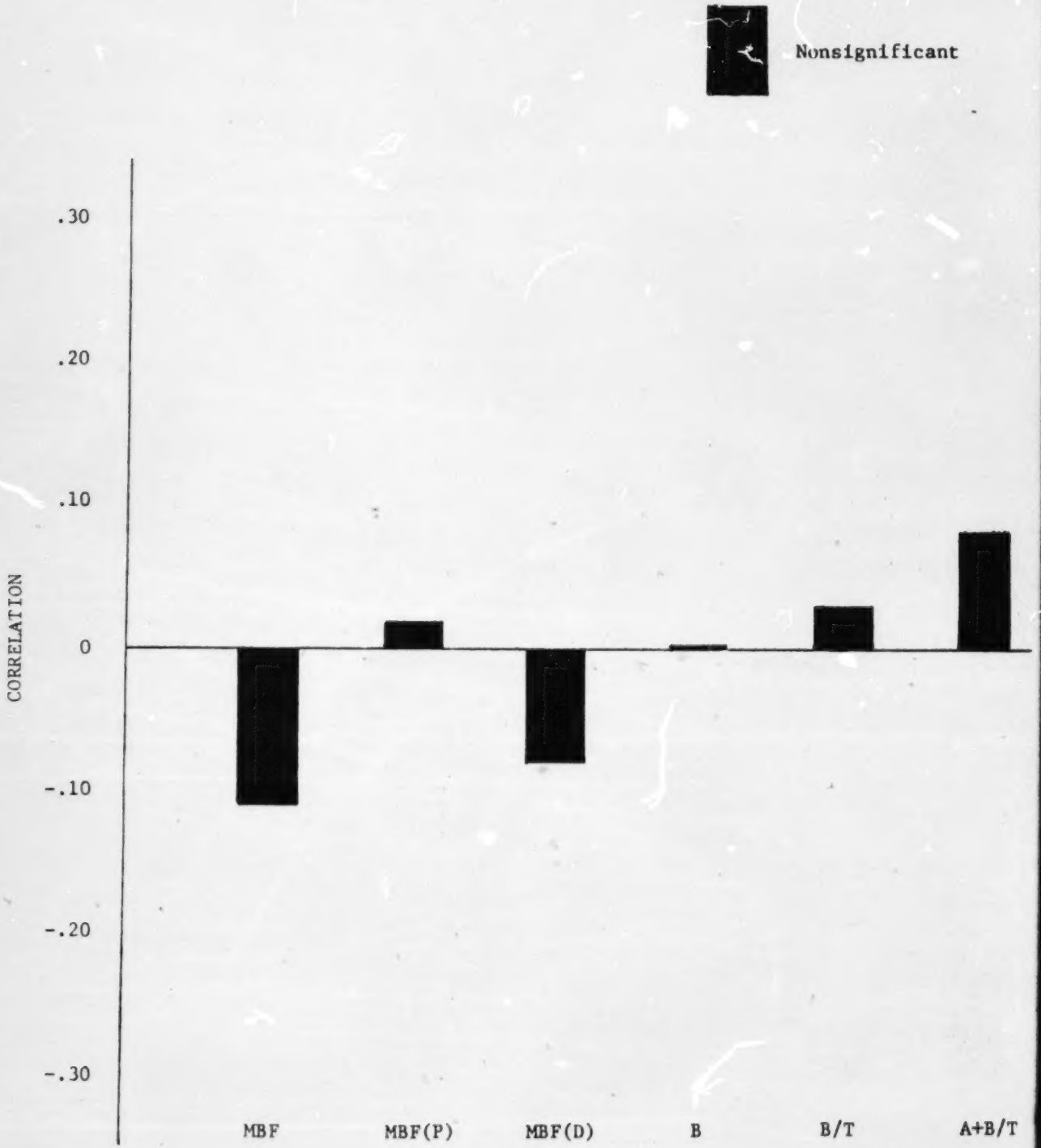

Figure 3: Correlation between Corman-Escalona Scales of Object Permanence and maternal behavior.